



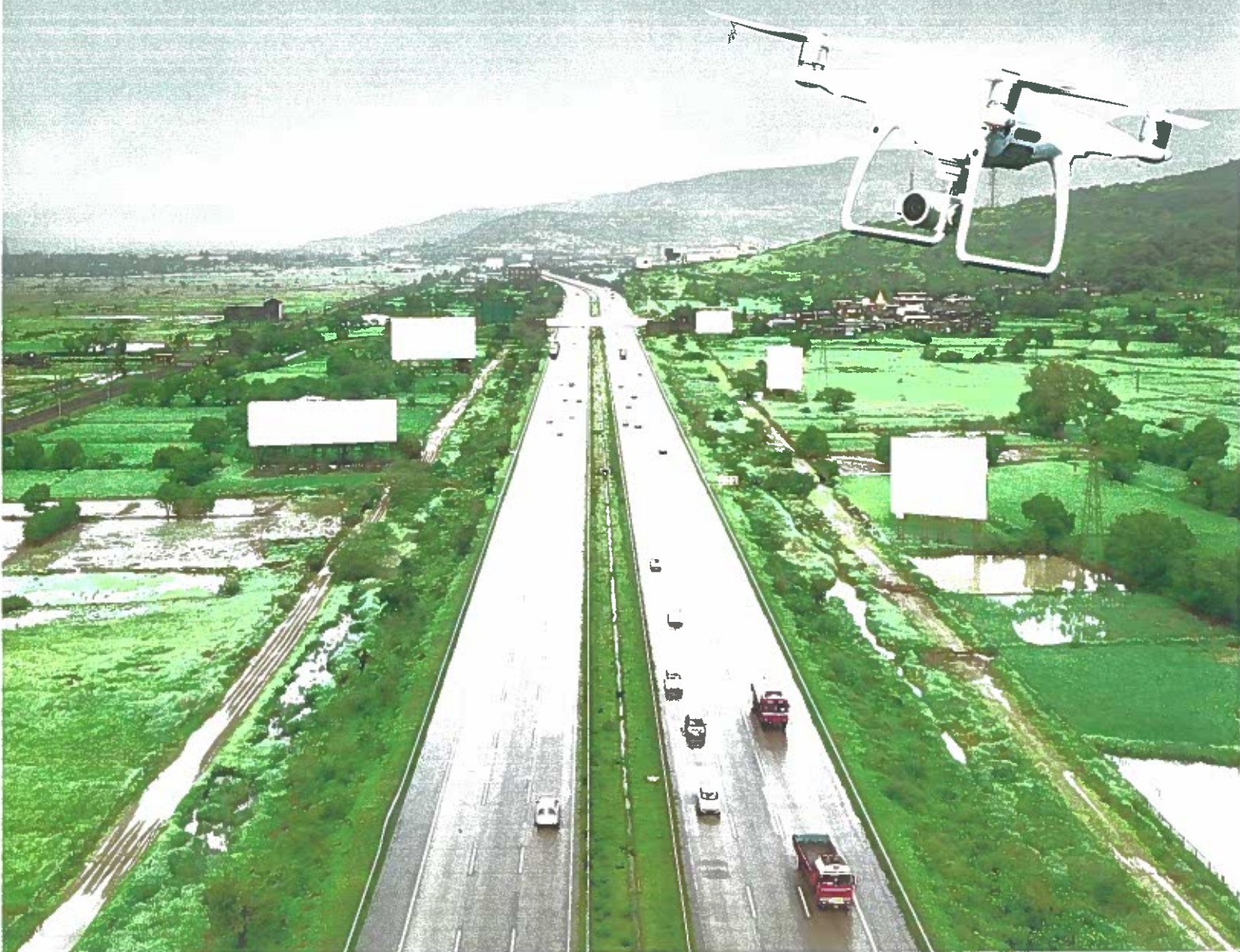
Ministry of Civil Aviation
Government of India



DRONE

ECOSYSTEM POLICY ROADMAP

JANUARY 2019





Contents



EXECUTIVE SUMMARY	01
1. PREAMBLE	03
2. VISION	04
3. MISSION	04
4. OBJECTIVES	04
5. IMPLEMENTATION	05
6. DRONE CORRIDOR	06
7. AIRWORTHINESS	07
8. COMMERCIAL OPERATIONS OF UAS	09
9. NIGHT-TIME OPERATIONS	09
10. UAS TRAFFIC MANAGEMENT SYSTEM	10
11. UNMANNED AIR TRAFFIC MANAGEMENT	11
12. REMOTE PILOT TRAINING	12
13. AUTONOMOUS UAS	12
14. DRONEPORTS	13
15. CARGO & DELIVERY CAPABILITIES	13
16. BOOSTING MAKE IN INDIA INITIATIVE	14
17. DATA PROTECTION AND PRIVACY BY DESIGN	14
18. ADOPTING BEST PRACTICES	15
19. INSURANCE	15
20. PENALTIES	15
REFERENCES	16

EXECUTIVE SUMMARY

After the launch of the DigitalSky Platform under Civil Aviation Regulations ("CAR") 1.0 with effect from December 1, 2018, a basic framework for regulations has been established. The focus now has been on addressing challenging frontier issues such as Beyond Visual Line of Sight ("BVLOS") & Autonomous Operations. Ministry of Civil Aviation has constituted a task-force on the recommendation for CAR 2.0 under the chairmanship of Hon'ble Minister of State for Civil Aviation. Pursuant to responsibilities handed over to the sub-committee on Regulations and Policy, we take the opportunity to present a draft policy note on CAR 2.0 along with our recommendations.

At the outset, we wish to highlight that CAR 2.0 may either be introduced as an amendment to the existing CAR 1.0 or it may also be introduced as separate set of Civil Aviation Requirements notwithstanding the conditions laid down under CAR 1.0.

In this drone ecosystem roadmap, we recommend key principles that should guide the drafting of the CAR 2.0. Our basic tenet is that no operation should be allowed over civilian airspace unless manufacturers meet certain standards, and operators prove safety of all stakeholders in designated test zones. Further, even after such demonstrations, operations are only allowed in well-defined Drone Corridors. The regime of No Permission, No Take-off ("NPNT") will continue in this CAR 2.0, to provide security from unauthorized flights. For privacy, we require manufacturers to adhere to a privacy by design standard, eliminating risks of future privacy harms by operators. Overall, the CAR 2.0 enables innovation without significantly compromising safety, security or privacy.

Recommendations for the purpose of CAR 2.0 may include:

- (a) **BVLOS Operations:** Expansion of operational airspace for UAS operating beyond the visual line of sight and above the current limit of 400 ft.
- (b) **Autonomous Operations:** Use of algorithms for piloting may be permitted, but only if adequate safety, security and privacy principles are demonstrated in the design of operations.
- (c) **Drone Corridor:** A segregated airspace defined by the appropriate authorities in consultation with the airspace designers to keep commercial UAS operations out of the non-segregated airspace in which manned aircrafts operate.
- (d) **Airworthiness:** New principles of air worthiness can be introduced to include safety by design, security by design and privacy by design.



- (e) **UAS Traffic Management:** A UAS Traffic Management should be responsible for managing UAS induced traffic, especially in the Drone Corridor.
- (f) **DigitalSky Service Providers:** DSPs may engage in providing enabled services to the UAS Operators, DigitalSky Platform, relevant law enforcement authorities and/or any other stakeholders.
- (g) **Pilot Training:** Improved and advance pilot training methods should be introduced to meet the professional requirements under CAR 2.0.
- (h) **Droneports:** Designated areas dedicated to facilitate take-off and landing of the UAS.
- (i) **Payload / Cargo:** Commercial UAS operations will foster various new forms of air freight capabilities.
- (j) **Make in India:** 100% FDI in UAS and RPAS-based commercial civil aviation services would provide a boost to the make in India initiative in this industry.
- (k) **Insurance:** Considering the increased exposure due to commercial operations, it becomes important for UAS operators to have a professional liability insurance to cover the cost of legal fees and damages awarded against such operators.

1. PREAMBLE

The Unmanned Aircraft System ("UAS") market in India is projected to touch US\$ 886 million by 2021, while the global market is likely touch US\$ 21.47 billion.¹ In order to tap into the opportunities in this space, India must regularly guide technology standards and upgrade its policy framework accordingly.

In CAR 1.0, a basic framework for regulating drone was laid out. It specified categorization of drones into classes based on weight, a quick indicator of potential for harm. Further, a minimum set of manufacturing guidelines were introduced to introduce elements of safety, security and privacy protection. Significant amongst these was the introduction of the No Permission, No Takeoff ("NPNT") regime for self-enforcement. NPNT requires all manufacturers to implement firmware & hardware changes that only allow flights as authorized by DGCA to physically take-off. That is, no drone will be able to fly without first specifying to the DGCA its intended flight envelope, time of flight and pilot credentials.

Further, multiple restrictions on operations were instituted to limit potential harm. CAR 1.0 only allowed registered, NPNT-compliant drones to be issued a Unique Identification Number ("UIN"). Drones with valid UINs may be permitted to fly up to a maximum ceiling of 120 m (400 ft). A pilot was required for every operation, and the drone could only operate within line of sight of the pilot. Operations from moving platforms or vehicles was also not permitted.

The process of registration, seeking authorization and co-ordination with government agencies takes place on the DigitalSky platform. For the ease of use of operators, airspaces in the country are pre-categorized as No fly zones (Red), some operations permitted (Amber) and all operations permitted (Green). The DigitalSky platform provides paperless convenience for requesting all permissions, and automates issuing of permissions in Green zones, significantly speeding up the process. This provides transparency and accountability for both regulators and operators. DigitalSky and Dynamic Zoning also allowed regulators to respond quickly to security and safety needs by being able to limit permissions in areas where they may be sudden security, safety or privacy challenges.

The proposed CAR 2.0 looks to expand the scope of operations to include autonomous flying, should seek to develop a sound regulatory framework by introducing the highest standards of safety, security, airworthiness, operational approval, maintenance and licensing for commercial and autonomous use of UAS and further enable the operations beyond visual line of sight.

CAR 2.0 should encourage development of infrastructure (such as UAS Traffic Management ("UTM") system, Drone Corridor and Droneports) necessary for expansion and penetration of UAS-based commercial services, without compromising on safety and security. Consequently, an evolving infrastructure would also increase job opportunities and simultaneously incentivize domestic as well as foreign technology advancements and investments in this space.

CAR 2.0 should also consider the direction in which the autonomous UAS technology ought to be developed and the ethical framework to be incorporated in the operational and functional design of such autonomous UAS, if permitted. This aspect is crucial, as it shapes the technological future of the Indian society.

Considering India's varied topographic and demographic profile, it is important that the policy governing commercial use of UAS and Autonomous UAS remains conscious and sensitive to the factors unique in Indian context. This would not only help in effective implementation of CAR 2.0, but also help promote an environment conducive for social and economic development of the country.

2. VISION

To foster innovation in the UAS market by enabling commercial use of UAS including autonomous UAS and expanding its operability beyond visual line of sight. Further, to realize the tremendous potential of the Indian UAS market in the form of economic growth, public and societal welfare and job creation; and position India as a global leader in this space.

3. MISSION

- (a) To ensure high and uniform level of safety for UAS operations.
- (b) To foster innovation, entrepreneurship and competition and build infrastructure capabilities.
- (c) To attract technology advancements and investment, both domestic and foreign.
- (d) To provide alternative solutions to critical and high-risk problems.

4. OBJECTIVES

- (a) Enabling the DigitalSky framework to dedicate dynamically segregated airspace, specifically for commercial use of UAS and BVLOS operations.
- (b) Enabling autonomous operations without compromising safety, security or privacy of citizens.
- (c) Enabling a digital and online regulatory system with real-time authentication, self-enforcement and real-time traceability capabilities.
- (d) Enabling use of UAS for commercial activities which are not explicitly prohibited by the concerned authority.

- (e) Enabling research and development supporting technological innovations in the UAS industry and research institutions.
- (f) Enabling advanced infrastructure and governance capabilities.
- (g) Adopting a human-centric, risk-based and capability-based regulatory framework for all UAS operations conducted in the Drone corridor.
- (h) Enabling foreign investments and level playing field for domestic and international players.
- (i) Enhancing ease of doing business through digitized procedures and e-governance

5. IMPLEMENTATION

CAR 1.0 was the result of a consultative process, and laid down the foundation for UAS operations in India. The government and the industry evolving and iterating to come up with better, more relevant policies to keep the Indian market competitive. Therefore, to enable CAR 2.0 to be the regulation for the future of UAS industry in India, it must be equipped to tackle challenges that were not envisioned at the stage of CAR 1.0.

Successful implementation of CAR 2.0 for commercial usage of UAS, for operations beyond visual line of sight and for operation of autonomous UAS, is a factor of several combinations including safe and secure airspace for UAS, advance infrastructure to manage the UAS traffic, decentralization of DigitalSky Platform and allow access to DigitalSky Service Providers ("DSP") for effective management, flexibility to adopt ever-changing technology, formulating an ethical framework for autonomous UAVs and innovation of new concepts to suit the varied topographic and demographic profile of India.

Appropriate authorities should be made responsible for licensing and authorizing UTM, DSPs and other similar infrastructure service providers to operate in the DigitalSky. In this regard, we emphasize the need for a Drone Directorate within the Directorate General of Civil Aviation. The Drone Directorate may issue necessary guidelines, which may be updated faster, as the needs of a nascent drone industry differ from those of the mature Civil Aviation Industry. Similarly, there is a need for a Member, DigitalSky - an analogue of Member, Air Navigation Service, but specializing in airspace issues arising from usage of UAS. The Member, DigitalSky may be given responsibility for maintain existing DigitalSky Platform, and upgrading it to meet the technological demands for operations beyond visual line of sight and operation of autonomous UAS.

6. DRONE CORRIDOR

- i. CAR 1.0 allows UAS operations to be carried out in both segregated and unsegregated airspace of up to 400 ft. above the ground level (approx. 120 meters) and within the visual line of sight, subject to conditions prescribed therein. However, for expansion and penetration of UAS-based commercial services and to enhance the capabilities of UAS, it is important that the operational airspace for UAS is expanded to allow beyond visual line of sight and above the current limit of 400 ft. operations in segregated airspace corridors.
- ii. Till such time the UAS for commercial use are not certified as safe to fly alongside manned aircraft, they should be kept away from airspace in which manned aircrafts operate. Alternatively, Drone Corridor i.e. an airspace segregated from flight paths of manned aircraft (with adequate safety buffer) should be provided for UAS operations. The Corridors can be defined by the Member, DigitalSky in consultation with the Drone Directorate to include the segregated airspace in which UAS may operate without the need to communicate with the Air Traffic Controller.
- iii. All Beyond Visual Line of Sight Operations may only be carried out in designated Drone Corridors, such that:
 - (a) The UAS is certified as airworthy to fly in that particular Drone Corridor, and
 - (b) The UAS is being flown for the same purpose as was specified in the specification, and
 - (c) The UAS is not carrying any unauthorized payload that are not incidental to the purpose of the operation, and
 - (d) The UAS may only take-off from a designated droneport qualified to handle operations of that UAS type, and
 - (e) The UAS may only land in a designated droneport qualified to handle operations of that UAS type, except in the case of emergency landing, or as may be commandeered by the appropriate authorities under bimodal control.
- iv. Further, while designing the Corridors following factors may be taken into consideration:
 - (a) Limiting human presence i.e., there is limited recognized human presence within the corridor during the period of operation;
 - (b) No high-value assets that are incidental to the expected purpose of operation;
 - (c) Height of the flight / operations on the basis of air and ground risks (considering collision avoidance with others UAS, persons, manned aircrafts and critical infrastructure);
 - (d) Connectivity with the UAS and UTM;
 - (e) Sensitive zones can be earmarked where flying would be completely prohibited - "No Fly Zones".

7. AIRWORTHINESS

- i. Relevant standards for certifications of airworthiness for UAS operations have been prescribed under CAR 1.0. However, it is undeniable that BVLOS operations heightens the reliability concerns relating to operator control systems, control data links and onboard power while also resulting in a multifold increase in the potential for injury and/or damage to third party people/structures due to the ability to fly at altitudes great than 400 ft.
- ii. Therefore, the regulatory requirements of airworthiness should be independent of operational / risk environment assuming the highest risk. Thus, initially a common high-risk environment across the country for reasons of risk management about airworthiness regulations would be feasible.
- iii. Additionally, the certification task for innovative, diverse and new roles to be undertaken by the UAS can be subjected to additional airworthiness requirements depending on the specific nature, role or environment of the UAS operation.
- iv. These airworthiness certifications would be issued to a manufacturer for every "UAS type" and manufacturers must attest that every subsequently produced UAS complies with the standards it was certified for.
- v. The Drone Directorate may prescribe a maximum lifecycle for each drone-type and operators must apply for re-certification at the end of the lifecycle of the drone.
- vi. While granting an airworthiness certification to a manufacturer, the following guiding design principles may be considered:
 - a) Safety by Design: Every UAS should be designed, manufactured, remanufactured, refurbished or rebuilt with safe design and manufacturing considerations as currently prescribed under CAR 1.0. Further, depending on other relevant information necessary to ensure safe and proper operating procedures, additional standards for certification may be laid down by the concerned authority.
 - b) Security by Design: The UAS and the embedded software should be designed to implement end-to-end security by ensuring continuous monitoring, tracking, tamper proofing, trusted hardware design, sense and avoid capabilities and standardized emergency responses.
 - c) Privacy by Design: Privacy principles must be embedded into the functional design of the UAS, by introducing technical measures that enable privacy as the default setting.
- vii. The following elements may be considered as part of an airworthiness approval:
 - a) Safety related aspects of aircraft performance & flight characteristics.
 - b) Design and production of aircraft structure (including launch and recovery loads).
 - c) Design and production of mechanical/hydraulic/pneumatic systems.
 - d) Design and production of aircraft propulsion system.

- e) Design and production of avionic systems and equipment (including software).
- f) Design and production of each sensor failure of which would prevent continued safe flight and landing should be such that the failure of one sensor will not interfere with the proper supply of energy to the remaining sensors and the failure of the energy supply from one source will not interfere with the proper supply of energy from any other sources.
- g) Security Design and Security Vulnerability assessment of hardware of avionic systems and equipment (including software).
- h) Compliance to NPNT Technical Standards or any other DigitalSky compliances at hardware or software level as may be issued by appropriate authority(ies).
- i) The instructions for continued airworthiness.
- j) Flight Manual, including standard emergency procedures and limitations.
- k) Safety assessment of the UAV communication link including its susceptibility to environmental effects (animate objects such as birds, lightning and any other interference)
- l) The design and production of any element of the control station the failure of which could prejudice safe control of the aircraft.
- m) Design and production of any flight termination system.

The above can be validated upon the grant of the certificate of airworthiness / commercial operating permits.

- v. The UAS should be able to avoid all static and dynamic-collaborative obstacles at a total system and/or human reaction time sufficient to prevent hazardous or catastrophic failure condition.
- vi. Requirement of enhanced configurations to determine the airworthiness standard may be adopted by the DGCA from time to time for the purpose of obtaining an Unmanned Aircraft Operating Permit ("UAOP") in cases of BVLOS operations and high-risk commercial operations.
- vii. The requirements for UAS that are considered critical for safe BVLOS operations:
 - (a) Failure Management Systems
 - (b) Navigation/Flight Control Systems
 - (c) Communication Systems
 - (d) Detect and Avoid Systems

Inclusion of these systems, supplemented with the requirements under CAR 1.0, are expected to provide higher level of assurance to mitigate the risks.

8. COMMERCIAL OPERATIONS OF UAS

- i. In a country like India with a significantly large consumer base, commercial operations of UAS have a great potential. Such activities may include transportation of bodily organs or non-living medical products, discharge of materials for supplementing agricultural irrigation, surveying landscapes and active monitoring of rail/road traffic, survey/inspections of agricultural land and aiding government policies such as the Pradhan Mantri Fasal Bima Yojana and any other cases which are not explicitly prohibited by the concerned authority.
- ii. Further, in addition to the requirement of Standard Operating Procedure under Paragraph 12.1 of CAR 1.0, UAS Operators seeking special permit for commercial operations of UAS must be required to submit commercial operations manual and a risk management manual.

9. NIGHT-TIME OPERATIONS

- i. To obtain permission for night flights, in the addition to the above, the UAS operator should have completed a Proof of Concept ("POC") to the satisfaction of the concerned authority(ies). Such POC, once approved, shall be valid for all night operations conducted by the UAS operator till the prescribed maximum lifecycle for the relevant drone-type.
- ii. Additionally, the following requirements should be fulfilled in order to operate night flights:
 - a) The UAS must be equipped with lights making it possible for other aircraft to avoid collision with the UAS during flight.
 - b) Take-off and landing area or the droneports must be sufficiently lighted for all bystanders in the area to know that the UAS is being operated.
 - c) Before the operations of the UAS, the operator must have reconnoitered the area covered by the flightpath in daylight.
 - d) The Drone Directorate may specify standards for Droneports as may be required from time to time, that Droneport Operators are expected to comply with.
 - e) Droneports may be inspected for compliance to these standards by the Drone Directorate or any agency(ies) it may authorise to do the same.
 - f) Fulfillment of any other conditions as determined by the concerned authority(ies).

The above can be validated upon the grant of the certificate of airworthiness / commercial operating permits.



10. UAS TRAFFIC MANAGEMENT SYSTEM

- i. A UAS Traffic Management (UTM) system should be devised to provide hyper-local and real-time information for managing UAS induced traffic, especially in the Corridors.
- ii. Considering the widespread potential for UAS operations in India and varied demands, it is important that a federated architecture of the UTM system is put in place, under the aegis of a centralized body (AAI), wherein the DSPs may provide UTM and related services modularly via Application Programming Interfaces (APIs) vis-à-vis the DigitalSky Platform.
- iii. The UTM system should ensure that it is equipped with the following technical capabilities:
 - a) **Detect and Avoid:** A system that enables UAS to spot obstacles or dangers and accordingly avoid collision, without the need for human intervention.
 - b) **Procedural Separation:** A method of air traffic control to mitigate the risk of collision by separating the time of operation on predetermined airspace routes.
 - c) **Corridors:** Carving out spatial areas within the airspace, where the UAS must limit its operation. These corridors may take any shape or design i.e. in the form of zones, cones, cylinders, tubes or multiple connected tubes, for the purpose safely and efficiently separating air traffic.
- iv. For the purpose of managing an efficient UTM system and to address the variable issues that may arise in UAS operations, the following capabilities may be embedded in the UTM system:
 - a) **Dynamic Re-routing:** With flight paths expected to change dynamically (in case of emergency situations or notification of ad-hoc red zones), dynamic re-routing enables the utilization of all available airspace capacity on real-time basis.
 - b) **Dynamic De-confliction:** By optimizing situational awareness of the UAS, any imminent conflict or collision can be bypassed by modifying flight path on real-time basis.
 - c) **Geo-fencing:** Concerned authorities may authorize flight permissions by implementing dynamic geo-fencing, in two ways:
 - i. Trajectory based - The UAS may operate only along permitted trajectory in the airspace
 - ii. Area based - the UAS can only operate in a permissioned area in the airspace.
 - d) **Counter UAS Solutions:** To counter the misuse of UAS, the concerned authority may adopt following measures, for a safe and efficient UTM system:
 - i. Ability to track, detect, identify and engage hostile UAS.
 - ii. Electronically disrupt the operation of rogue UAS.

- iii. Any other technical capability as may be agreed upon by the relevant authority in consultation with the experts to address the ad-hoc issues that may arise, on a real-time basis.
- e) **Artificial intelligence and Machine Learning:** AI may also be considered to be integrated in the UTM system to perform tasks of dynamic re-routing and de-confliction, more efficiently than humans.
- f) **Bimodal control :** All UAS manufactured, imported or operating in India, must allow for bi-modal control by the UTM service provider such that :
 - i. Each UAS must be equipped with appropriate navigation and communication software and hardware to allow for live telemetry and other data exchange with UTM service provider
 - ii. Each UAS must allow for operational command to be transferred to UTM service provider, at any time during flight, as and when directed by the UTM
 - iii. Each UAS must be capable of executing manoeuvres as instructed by the UTM service provider, in real time, including adjusting attitude, altitude, velocity and performing emergency landings or return to home procedures.

11. UNMANNED AIR TRAFFIC MANAGEMENT

- i. To meet the increased demands of the proposed expansion of UAS operations, it would also require expansion of the current DigitalSky ecosystem by introducing new players in the form of DSP under CAR 2.0. These DSPs may engage in providing enabled services to the UAS Operators, DigitalSky Platform, relevant law enforcement authorities and/or any other stakeholders.
- ii. A DSP may be a public or private agency registered in India, that uses the data made available through the DigitalSky Platform to provide the requisite services.
- iii. The existing DigitalSky Platform should be customized to meet the technological demands under CAR 2.0 pertaining to commercial usage of UAS and for operations beyond visual line of sight. Further, steps should be taken towards sharing of necessary information/details with the local law enforcement agencies on real-time basis for effective implementation of law and order in the place of operation of the UAS.

12. REMOTE PILOT TRAINING

- i. A risk free environment for the commercial use of UAS and BVLOS operations would largely depend upon the operations of the UAS by the Remote Pilot. Therefore, to minimize the risks, it is important to ensure that all Remote Pilots have undertaken necessary certifications and practical training for operations of the UAS in the Corridor.
- ii. All records in relation to the history of each Remote Pilot (such as number of flights, flight logs, occurrences - if any, training records, compliance records etc.) should be maintained and the same should be factored in while granting necessary clearances.
- iii. The training program for Remote Pilots should include teaching theoretical subjects intended to equip them with the similar knowledge as that of an aircrew of a manned aircraft or a private pilot license holder to enable the Remote Pilot to control the operation of a UAS under any and all circumstances. This would enable the Remote Pilots to control the UAS throughout its operating conditions, including safe recovery during emergencies and system malfunction.
- iv. Foreign nationals with remote pilot license from the relevant authority outside India must be required to obtain necessary certifications in India to operate UAS in the Corridor.
- v. Remote Pilots having knowledge of any physical or mental condition that would interfere with the safe operation of an UAS should be prohibited from operating an UAS. To assess the fitness of a Remote Pilot for undertaking UAS operations, they should also be subject to similar conditions as applicable to the pilots of manned aircraft under the Aircraft Rules, 1934.
- vi. The Remote Pilot should be able to perform emergency recovery in the event of critical system failures as soon as practicable.

13. AUTONOMOUS UAS

- i. Operators that deploy and use autonomous UAS should ensure that the UAS is human-centric i.e. it should be developed, deployed and used for an ethical purpose, and its operation must demonstrate respect for the ethical principles of Beneficence (do good) and Non-Maleficence (do no harm).
- ii. Autonomous UAS should not under any circumstance harm human beings and should, by design protect the dignity, liberty, privacy, safety of human beings.
- iii. To reduce the possibility of harm from autonomous UAS operations the training of algorithms should be based on the data collected from POC conducted by UAS that have incorporated principles such as safety by design, security by design and privacy by design.

- iv. The use of assisted-flying models, semi-autonomous or mixed-autonomous models, such as a “follow me” mode or flying of “swarms” of drones through the operation of a lead drone, will also classify as autonomous flying. These “swarms” of drones must individually as well as a group, demonstrate the principles outlined in this section.

14. DRONEPORTS

- i. Droneports are proposed to be designated areas dedicated to facilitate take-off and landing of the UAS. However, overtime their capabilities may be enhanced to function as distribution centers (or cargo holds), battery charging stations and/or any other appropriate use. Licensing of such ports may be granted by the concerned authorities upon meeting the prescribed technical requirements.
- ii. Droneports owners may be designated as DSP and they shall have an obligation to maintain records of every take-off/landing activity or any other activity taking place on their property.
- iii. Take-off or landing areas for a UAS other than recognized droneports, may act as a temporary droneports (for the take-off / landing purposes only) provided they meet some necessary safety and security standards as may be prescribed.
- iv. Droneports must be designed to promote a systematic interoperable droneport ecosystem, which is seamlessly integrated with the DigitalSky Platform and must be listed on the national droneport registry.

15. CARGO & DELIVERY CAPABILITIES

- i. Commercial UAS operations will foster various new forms of air freight capabilities, such as creation of supply chain relay networks for delivery of payload, transport of temperature sensitive commodities like bodily organs, emergency or just-in-time deliveries of life-saving medicines or safe blood for transfusions and collection of patient specimens for delivery to laboratory for time-sensitive testing.
- ii. Risks involved in carrying payload as indicated above would depend on the type, weight and the space occupied by the payload and its feasibility can be assessed accordingly. Accordingly, in addition to the POC, risks can be mitigated under CAR 2.0 by requiring the UAS Operators undertaking cargo operation to engage in self-regulations and formulating commercial operation and risk management manuals. Such manual(s) should explicitly prohibit carrying of payload which are prohibited by the concerned authorities under the applicable law.

- iii. Investments in the development of droneports can be leveraged to enable more timely and effective management of cargo operations and enable safety in the case of discharge and transfer of payload.

16. BOOSTING MAKE IN INDIA INITIATIVE

- i. 100% Foreign Direct Investment ("FDI") should be permitted under the automatic route in UAS and RPAS-based commercial civil aviation services, subject to the financial threshold applicable to non-scheduled air transport operators.
- ii. UAS for civil purposes and UAS for defense purposes should be distinguished and manufacturers of UAS for civilian use should not be subject to licensing requirement specifically made for the defense sector.
- iii. Provide updated guidance in relation to the International best practices relating to hardware and software requirements to be adopted by UAS manufacturers in India.
- iv. Availing necessary benefits under the "Start Up Policy" for Indian drone companies fulfilling the requirements of a startup.
- v. Consider granting of UIN where the RPAS is owned by a body corporate that is a subsidiary of a company or corporation registered elsewhere than in India.

17. DATA PROTECTION AND PRIVACY BY DESIGN

- i. For the purpose of mitigating risks pertaining to privacy, protection of personal data or personal security arising from the operation of UAS, the original equipment manufacturers ("OEM") can be required to include corresponding and specific features and functionalities which can take into account the principles of privacy and protection of personal data by design and by default. This is also in consonance with the international best practices.
- ii. DSPs should be required to include data protection by design features i.e. implementing appropriate technical and organizational measures designed to implement data-protection principles as part of any UAS operation that collects personal data, and to integrate the necessary safeguards to protect the rights of data principals.
- iii. DSPs collecting personal data should be required to establish feedback and review mechanisms including requests to access, anonymize, or erase the data of the data principal.
- iv. Minimum training requirements for Remote Pilots should include knowledge of the relevant Indian privacy/data protection regulations.
- v. Once implemented, such additional standards and compliances as required under the new data protection law.

18. ADOPTING BEST PRACTICES

Presently, CERT-IN is a functional organization that has the objective of securing the Indian cyber space. It engages in activities like preventing cyber-attacks against India, advising on best practices, coordinating with industry players etc. Drawing from the aforementioned, establishing a designated body who shall be responsible for providing guiding principles for the operations of UAS along with undertaking the following functions:

- i. Establishing Standard Operating Procedures and response system for any emergency situations.
- ii. Collect, analyze and disseminating information on UAS safety and breach incidents.
- iii. Advising on best practices and procedures.
- iv. Such other functions relating to the operation of UAS as may be prescribed.

19. INSURANCE

- i. UAS operators under CAR 2.0 should be required to maintain comprehensive insurance to cover the liability towards the cargo, hull loss and third-party risks that may be possessed due to commercial and/or BVLOS operations of the UAS in compliance with the Carriage by Air Act, 1972 or any other applicable law.
- ii. Liability considerations are expected to become increasingly significant for UAS used for commercial operations and autonomous UAS. Therefore, having a professional liability insurance in such scenario can cover the cost of legal fees and damages awarded against UAS operators.

20. PENALTIES

- i. In case of violation of provisions of CAR 2.0, necessary actions shall be taken as per the relevant sections of any statutory provisions as laid down under the Central, State or local laws including, but not limited to, the Aircraft Act 1934, the Aircraft Rules 1937 and the India Penal Code, 1860.
- ii. The concerned authority may initiate a complaint against an entity in the DigitalSky ecosystem for failure to provision of CAR 2.0. Adjudicating Officers appointed by the concerned authority shall decide such matters, and upon found guilty, may impose large financial penalties or suspend / cancel the UIN/ UAOP issued by DGCA to the defaulter.

REFERENCES

1. DGCA RPAS Guidance Manual
2. Report of Airspace Management Sub-Committee of Unmanned Aircraft System Task Force
3. DigitalSky Manual
4. DigitalSky - Technology Standards
5. Concept Paper on Enabling Beyond Visual Line of Sight (BVLOS) UAS Operations in India
6. Australian Rural and Regional Affairs and Transport References Committee on Current and future Regulatory requirements that impact on the safe use of Remotely Piloted Aircraft Systems, Unmanned Aerial Systems and associates systems.
7. Australia: Advisory Circular on Remotely piloted aircraft systems - operation of excluded RPA
8. Danish Transport Authority on Future regulation of civil drones Report from an inter-ministerial working group
9. EASA Report on Study and Recommendations regarding Unmanned Aircraft Geo-Limitations
10. EASA - Drone Collision Task Force Final Report
11. EASA Opinion No 01/2018: Introduction of a regulatory framework for the operation of unmanned aircraft systems in the 'open' and 'specific' categories
12. Singapore: Assessment Methodology for Beyond Visual Line of Sight
13. Unlocking the UK's High Tech Economy Consultation on the Safe Use of Drones in the UK Government Response